Noteworthy anatomical and physiological researches.

The rhizoids of filamentous algæ.[1]

While a few theories have been advanced to explain the occasional formation of rhizoids on those forms of filamentous Chlorophyceæ on which rhizoids do not normally occur, the author is the first to attempt to demonstrate their cause by experiment.

The observations were made from artificial cultures of two kinds, the so-called "contact cultures" and suspended cultures. In the former, the cultures were made either on a slide, between a slide and a cover glass, or in a hanging drop. In the suspended cultures a tuft of algæ is tied about the center with a slender linen thread, all rhizoids having first been removed, and suspended in a culture fluid. By this means liability of one filament coming in contact with another is in most cases removed. Various substances were used in making the media, and these in different degrees of concentration. The author gives in detail cultures made in solutions of agar-agar, gum, albumen, urea, cane sugar, milk sugar, erythrite, asparagine, glucose, dulcite, mannite and glycerine, and mentions cultures made in solutions of citric acid, berberine, potassium tartrate, sodium chloride, potassium nitrate, potassium sulphate, magnesium sulphate, sodium nitrate, aluminum sulphate, potassium alum, and in stained solutions of indigo carmine and nigrosin. None of the latter, however, were very successful, as the staining prevented the free action of light, and in the others the algæ died, even in very weak solutions.

The first results were obtained in contact and water suspension cultures; these were followed by the various other suspension cultures. As a result of these experiments he concludes that rhizoid formations of Spirogyra depend upon certain external influences from contact with a firm body. Notwithstanding the great number of cultures made, he confesses that his investigations are insufficient to fully explain the nature of these external influences.

At the two extremes of the series are the contact cultures

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[1] BORGE, O. *Ueber die Rhizoidenbildung bei einigen fadenformigen Chlorophyceen.* Upsala, 1894.

and the water suspension cultures. In the one, rhizoid-like outgrowths were obtained in all cultures (thirty-one) of *Spirogyra fluviatilis* Hilse, *S. inflata* (Vauch.) Rab., *S. orthospira* Naeg., and in four undetermined species. In the other, in no case did the formation of rhizoids result. In some cases water suspension cultures which showed no result, when transferred to contact cultures developed rhizoids in from two to four days.

That other conditions influence this development is shown by the growth in different media, the required density differing with the different media, as well as with the species; *e. g.*, in agar-agar, the lowest limit favorable to the formation of rhizoids, was a .05 per cent. solution, while for a gum solution it lay between .5 and 25 per cent.

The development of rhizoids by contact culture was also attempted under the influence of darkness, but the conditions were unfavorable for the development of the filaments themselves although in some cases rudimentary rhizoids occurred during the first few days.

One of the most interesting results derived from the research was in connection with *S. varians* (Hass.); in this species no rhizoids were developed, but, contrary to the statements of Vaucher, Pringsheim and De Bary, the author concludes after observing the germination of the zygote in three different cultures that the so-called "rhizoid cell" of the germinating tube does divide to form the cellular increase of the filament.

Cultures of Zygnema showed no rhizoid growth. In the cultures of Mougeotia the rhizoids were also conditioned by external mechanical influences since none were formed except in contact cultures.

Similar cultures were made of Vaucheria and of those forms in which the formation of rhizoids is more or less normal; *i. e.*, Cladophora, Draparnaldia, Œdogonium and Ulothrix. While no rhizoids were obtained on mature threads of *Vaucheria clavata* (Vauch.) DC., their presence was observed on germinating filaments. On *V. sessilis* (Vauch.) DC. none were produced under any circumstances. Both old and young threads of Cladophora, Draparnaldia, and Ulothrix formed rhizoids under all conditions. On early germinating threads of Œdogonium rhizoids were formed in all cases but the property seems to have become lost in older threads.

In summing up, the author advances the theory that the

variations in the different species, at least in many cases, bear a close relation to the conditions of growth; so that those species which are generally found in rapidly flowing water formed rhizoids under all conditions and the rhizoid formation may be considered as a specific character. An entirely opposite condition exists in those species of Spirogyra which in no case formed organs of attachment (S. varians, Weberi and others not specifically named). *Spirogyra fluviatilis* and *Vaucheria clavata* may be regarded as a mean between the two extremes; these formed rhizoids but in contact cultures only, and he suggests that these might gradually have acquired this ability from species in which the necessity for rhizoids was originally wanting. This view confirms that of Klebs,[2] who suggests that *V. clavata* might be regarded as an offshoot of *V. sessilis* which has been removed from its accustomed habitat into rapidly flowing water.

The experiments were conducted in the laboratory of Prof. Klebs of Basel and the results are published in pamphlet form. Two plates illustrating the various results are appended to the text.

The work gives evidence of careful thorough investigation and it will be read with interest by all who have made a study of these forms of algæ.—BERTHA STONEMAN.

Investigations on bacteria.[3]

Under the above general title, Alfred Fischer has recently published a lengthy paper which, in part, deals with a subject that has received but scant attention from bacteriologists. The paper is divided into four parts, which treat respectively of plasmolysis of bacteria, physiology of motile organs, morphology of cilia, and systematic bacteriology.

In the first three parts, the author draws attention to many points of interest that he has observed in his studies, and discusses the relation of the same to the different theories that have been advanced from time to time.

I. He brings further proofs to substantiate his earlier claim[4] that the bacterial cell is subject to plasmolysis like the higher plant forms. Plasmolysis frequently occurs in the preparation of ordinary cover glass mounts where the evaporating

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[2]Zur Physiologie der Fortpflanzung von Vaucheria sessilis. Verhandl. d. naturforsch. Ges. in Basel **10:** —. 1892.

[3]Untersuchungen über Bakterien, Jahr. f. Wiss. Bot. **27:** 1–163. 1895.

[4]Ber. d. konigl. sächs. Ges. d. Wiss. —: 52. 1891.